RATHINAM COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

Rathinam Tech Zone, Eachanari, Coimbatore – 641021.

DEPARTMENT OF MATHEMATICS

Syllabus for

B.Sc. Mathematics

2024 – 2025 Batch onwards

Vision and Mission of the Institution

Vision

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsters whocan accelerate the overall development of India

Mission

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India

Motto

Transform the youth into National Asset

Vision and Mission of the Department

Vision

The Department aspires to the highest standards of excellence in teaching and service of humanity, through preparing students for learning Applied and Industrial Mathematics for the challenging growth of science and Technology.

Mission

The Mission of the Department is to provide an environment where students can learn and become competent users of Mathematics and Mathematical Application and also to provide quality Education, Research and Consultancy by providing highly skilled mathematical knowledge along with the industrial collaboration.

Motto

Empowering Minds through Mathematics

Program Educational Objectives (PEO)

PEO1:	Pursue a career as a globally competent and universally employable professional in core and related fields in diverse sectors who accelerates the overall development of India.
PEO2:	Pursue lifelong learning opportunities including graduate degrees to improve and expand domain specific and professional skills.
PEO3:	Advance personally and professionally by accepting professional and societal responsibilities, and pursuing leadership roles.

Mapping of Institute's Mission to PEO

Institute's Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	PEO1, PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2, PEO3

Mapping of Department Mission to PEO

Department Mission	PEO's
Impart Critical thinking ability to become more competency	PEO1, PEO3
Analytical Knowledge with Industry Collabration	PEO1, PEO2
Industry Collabration	PEO2, PEO3
Research Culture	PEO1 PEO2

Program Outcomes (PO):

PO1	:	Demonstrate knowledge competency in core discipline
PO2	:	Apply the appropriate knowledge and suitable skills in solving the complex problems
PO3	:	Conduct investigations of complex problems through various scientific approaches
PO4	:	Design solutions for complex and open ended real-life or real-time problems
PO5	:	Use appropriate and advanced tools for wide range of practices with an understanding on its associated limitations
PO6	:	Work effectively and responsibly as a member or a leader in a team
PO7	:	Express complex concepts within the profession and with society at large
PO8	:	Understand the professional roles and responsibilities
PO9	:	Analyze social and environmental aspects of the professional practices
PO10	:	Practice higher moral and ethical standards during the discharge of professional duties

PO11	:	Incorporate finer finance and business practices in all professional engagements
PO12	:	Identify and address their professional development through lifelong learning

Program Specific Outcomes (PSO):

PSO1	:	Understand and apply mathematical concepts in various contexts related to science, technology, business and industry.
PSO2	:	Acquire the knowledge to apply analytical and theoretical skills to model and solve mathematical problems
PSO3	:	Formulate and develop mathematical arguments in a logical manner.
PSO 4	:	Apply the critical thinking ability to carry out extended investigation and innovation of mathematical formulations.

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO 1	PEO 2	PEO 3
PO1	:	3	1	3
PO2	:	3	2	3
PO3	:	1	2	3
PO4	:	3	1	3
PO5	:	3	3	2
PO6	:	2	3	3
PO7	:	2	3	1
PO8	:	3	2	1
PO9	:	2	2	3
PO 10	:	3	2	1
PO 11	:	2	1	1
PO 12	:	3	2	2
PSO1	:	3	2	1
PSO2	:	2	2	1
PSO3	:	2	2	1
PSO4	:	3	3	2

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

Components considered for Course Delivery is listed below:

Class room Lecture

Laboratory class and demo

Assignments

Case Study

Project

Online Course

External Participation

Seminar

Internship

Mapping of POs with Course Delivery:

Program Outcome	Course Delivery								
	a	b	c	d	e	f	g	h	i
PO1	3	3	1	1	2	1	3	3	1
PO2	3	3	2	3	3	1	1	2	3
PO3	3	3	1	3	1	1	1	2	3
PO4	2	3	2	3	3	1	1	3	1
PO5	3	2	1	3	1	3	3	3	3
PO6	2	3	1	3	3	1	2	3	3
PO7	2	3	1	3	1	1	2	3	3
PO8	2	2	1	2	3	3	2	3	3
PO9	1	1	2	3	3	3	2	3	3
PO10	2	1	2	3	2	2	2	2	2
PO11	1	1	2	2	2	3	3	3	3
PO12	1	2	3	2	2	2	3	3	3
PSO1	2	3	1	3	2	3	1	3	3
PSO2	3	2	2	3	3	2	2	3	2
PSO3	2	3	3	2	2	3	3	2	3
PSO4	3	2	2	1	3	2	2	1	2

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

B.SC. MATHEMATICS DEGREE PROGRAMME

B. Sc (BMA) Curriculum Structure - Regulation – 2024

(For students admitted from 2024-2025 and onwards)

S.No.	Sem	Part	Sub Type	Course Code	Course Name	Credit	Hours	INT	EXT	Total
1	1	1	L1		Language – I	3	5	50	50	100
2	1	2	L2		English – I	3	5	50	50	100
3	1	3	Core		Core Course – I Theory	4	5	50	50	100
4	1	3	Core		Core Course – II Theory / Practical	4	4	50	50	100
5	1	3	Allied		Allied-I	4	5	50	50	100
6	1	4	SEC		Skill Enhancement Courses – IPractical / Training	4	4	50	50	100
7	1	4	AEC		Ability Enhancement Course I Environmental Studies or Universal Human Values & Professional Ethics	2	2	50	0	50
						24	30	350	300	650
1	2	1	L1		Language – II	3	5	50	50	100
2	2	2	L2		English – II	3	5	50	50	100
3	2	3	Core		Core Course – III Theory	4	5	50	50	100
4	2	3	Core		Core Course – IV Theory / Practical	4	4	50	50	100
5	2	3	Elective		Elective - I Entrepreneurship Development	4	4	50	50	100
6	2	3	Allied		Allied-II	4	5	50	50	100
7	2	4	AEC		Ability Enhancement Course II	2	2	50	0	50

					Design Thinking					
8	2	5	Ext		Extension Activity - I (NASA)	1	0	25	0	25
						25	30	375	300	675
1	3	1	L1		Language - III	3	4	50	50	100
2	3	2	L2		English – III	3	4	50	50	100
3	3	3	Core		Core Course – V Theory	4	6	50	50	100
4	3	3	Core		Core Course – VI Theory / Practical	4	4	50	50	100
5	3	3	Allied		Allied-III	4	5	50	50	100
6	3	4	SEC		Skill Enhancement Courses – II Practical / Training	4	5	50	50	100
7	3	4	AEC		Ability Enhancement Course III Soft Skill-1	2	2	50	0	50
8	3	3	ITR		Internship / Industrial Training (Summer vacation at the end of II semester activity)	2	0	50	0	50
9	3	5	Ext		Extension Activity - II (NASA)	1	0	25	0	25
						27	30	425	300	725
1	4	1	L1		Language - IV	3	4	50	50	100
2	4	2	L2		English – IV	3	4	50	50	100
3	4	3	Core		Core Course – VII Theory	4	6	50	50	100
4	4	3	Core		Core Course – VIII Theory / Practical	4	4	50	50	100
5	4	3	Allied		Allied-IV	4	5	50	50	100
8	4	3	Elective		Elective - II	4	5	50	50	100
7	4	4	AEC		Ability Enhancement Course IV Soft Skill-2	2	2	50	0	50

8	4	5	Ext		Extension Activity - III (NASA)	1	0	25	0	25
						25	30	375	300	675
1	5	3	Core		Core Course – IX Theory	4	6	50	50	100
2	5	3	Core		Core Course – X Theory / Practical	4	6	50	50	100
3	5	3	Elective		Elective - III	4	6	50	50	100
4	5	3	Core		Core Course-XI Theory	4	6	50	50	100
5	5	4	SEC		Skill Enhancement Courses – III Practical / Training	4	6	50	50	100
6	5	3	ITR		Internship / Industrial Training - (Summer vacation at the end of IV semester activity)	2	0	50	0	50
7	5	5	Ext		Extension Activity - IV (NASA)	1	0	25	0	25
						23	30	325	250	575
1	6	3	Core		Core Course – XI Theory	4	6	50	50	100
2	6	3	Core		Core Course – XII Theory / Practical	4	4	50	50	100
3	6	3	Elective		Elective – IV	4	6	50	50	100
4	6	3	PRJ		Core Project	4	4	100	100	200
5	6	4	SEC		Skill Enhancement Courses – IV Practical / Training	4	6	50	50	100
						24	30	300	300	600
					Total credit	144	180	2150	1750	3800

Additional Credits										
S.No.	**Sem**	**Part**	**Sub Type**	**Sub Code**	**Subject**	**Credit**	**Hours**	**INT**	**EXT**	**Total**
1	2	6	VAC		VAC - Microsoft CoE Course	2	2	50	0	50
3	4	6	IDC		VAC - Microsoft CoE Course	2	2	50	0	50
4	5	6	VAC		VAC - Microsoft CoE Course	2	2	50	0	50

Core – Theory

S.No.	**Sem**	**Pre-requesite**	**Course Code**	**Course Name**	**Offering Department**	**Type Theory / Practical**
1	1			Classical Algebra	Mathematics	Theory
2	2			Trignometry, Vector Calculus & Fourier Series	Mathematics	Theory
3	3			Differential Equations	Mathematics	Theory
4	4			Mechanics	Mathematics	Theory
5	5			Real Analysis I	Mathematics	Theory
6	6	Real Analysis I		Real Analysis II	Mathematics	Theory

Core - Theory / Practical

S.No.	**Sem**	**Pre-requesite**	**Course Code**	**Course Name**	**Offering Department**	**Type Theory / Practical**
1	1			Calculus using SCILAB	Mathematics	Theory/ Practical
2	2			Analytical Geometry using Geogebra	Mathematics	Theory/ Practical
3	3			Abstract Algebra	Mathematics	Theory
4	4			Linear Algebra	Mathematics	Theory
5	5			Complex Analysis	Mathematics	Theory

				I		
6	5			Discrete Mathematics	Mathematics	Theory
7	6	Complex Analysis I		Complex Analysis II	Mathematics	Theory

Allied

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Theory / Practical
1	1			Statistical Foundation of Data Analytics-I	Mathematics	Theory
2	2	Statistical Foundation of Data Analytics-I		Statistical Foundation of Data Analytics-II	Mathematics	Theory
3	3			Financial Accounting-I	Commerce	Theory
4	4	Financial Accounting-I		Financial Accounting-II	Commerce	Theory

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	12	16	14	16	18	16	92
Part IV	6	2	6	2	4	4	24
Part V	-	1	1	1	1	-	4
Total	24	25	27	25	23	20	144

Skill Enhancement Courses

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Practical / Training
1				SPSS Programming	Mathematics	Practical

2				Programming with C++	Mathematics	Practical
3				Operations Research I	Mathematics	Theory
4		Operations Research I		Operations Research II	Mathematics	Theory

Elective

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Practical / Training
1	2			Entrepreneurship Development	Mathematics	Theory
2	4			Scientific Computing using Matlab	Mathematics	Practical
3	4			Mathematical Modelling	Mathematics	Theory
4	5			Numerical Methods	Mathematics	Theory
5	5			Number Theory	Mathematics	Theory
6	6			Research Methodology	Mathematics	Theory
7	6			Graph Theory	Mathematics	Theory

Semester I

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Classical Algebra	4	5	-	-	Core Theory

Course Introduction

This paper enables the students to learn Binomial, Exponential, Logarithmic series and their application to summation of series and intensively study the convergence and divergence of different types of series.

Course Focus on: **Skill Development**/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	To determine the concepts of Binomial, Exponential, Logarithmic series and their application to summation of series.
CO 2:	To apply the appropriate tests to find the convergence or divergence of an infinite series.
CO 3:	To acquire a clear knowledge regarding methods to find approximate roots of the equations.
CO 4:	To analyze the relation between roots and coefficients of the polynomial equations.
CO 5:	To apply Descarte's rule of signs to find the number of positive and negative roots if any in a polynomial equation .

Unit I:	**Summation of Series using Binomial and Exponential Theorem**	**[12 Periods]**

Binomial theorem for any rational index – Exponential Series – Summations and Approximations related to these series-Applications.

Unit II:	**Logarithmic Series, Convergence And Divergence of Series**	**[12 Periods]**

Logarithmic series theorem - immediate application to summation and approximation - Convergency and divergency of series – definitions, elementary results- series of positive terms - comparison tests- Cauchy's condensation test

Unit III:	**Absolute Convergence of Series**	**[12 Periods]**

D'Alembert's ratio test and Cauchy's root tests - - Raabe's test - Absolute convergence.

Unit IV:	**Theory of Equations-I**	**[12**

		Periods]

Fundamental Theorem of Algebra – Relations between roots and Coefficients – Symmetric functions of roots.

Unit V:	**Theory of Equations-II**	**[12 Periods]**

Transformation of Equations – Reciprocal Equations - Descartes' rule of signs – Rolle's Theorem – Multiple roots: Newton's Method of Divisors

Text Books:

T.K. Manikavachagam Pillai, T. Natarajan and K.S. Ganapathi, "Algebra Volume I", S. Viswanathan pvt. Ltd,2004

Content

Unit I	Chapter 3, 4	Page Number: 124-130, 143-152, 189-212
Unit II	Chapter 2, 4	Page Number:213-245, 14- 27, 41-57
Unit III	Chapter 2	Page Number:57-89
Unit IV	Chapter 2	Page Number: 282 - 307
Unit V	Chapter 2	Page Number: 318-334, 340-358, 358-362,370-376

Reference Books:

N.P. Bali, " Algebra", Laxmi Publications pt. Ltd, New Delhi, 2009.

Arumugam & Issac, Classical Algebra, New gamma Publishing house, Tirunelveli, 2003.

Web Resources:

1. https://www.brainkart.com/article/Introduction-to-Binomial,-Exponential-and-Logarithmic-series_35107/

2. http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

3. http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	3	1	2			2				1	1	1	3	3		
CO2	3	1	3			3	3	3		1	1		3	2		
CO3	3	2	2	2		1	2				2	1	1	1		
CO4	3		1	2	1		1			2		2	1	1		

CO5	3		1	1	1		1				2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Calculus using SCILAB	4	3	-	1	Core Theory/Practical

Course Introduction

This paper enables the students to gain knowledge on fundamental principles, concepts and knowledge in the area of Differential and Integral Calculus.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will be able
CO 1:	To develop and understand the nature of differentiation and its applications.
CO 2:	To use derivatives to solve authentic real-life application problems.
CO 3:	To use the concepts of differential and integral calculus to solve multiple integrals.
CO 4:	To evaluate beta and gamma functions with respect to change in double integrals.
CO 5:	To examine the properties of Integrals and types of Integrals.

Unit I:	**Differential Calculus and Introduction to Scilab**	**[12 Periods]**

Successive Differentiation - Leibnitz theorem and its applications – Curvature –Radius of Curvature and Centre of Curvature-Introduction to Scilab-Working with Scilab-Plotting

Unit II:	**Integral Calculus:**	**[12 Periods]**

Properties of definite integrals - Integration by parts - Reduction Formulae - Bernoulli's formula- Scilab Simple Program

Unit III:	**Multiple Integrals:**	**[12 Periods]**

Definition of double integral - Evaluation of double integral - double integral in polar Coordinates - Triple integrals- Scilab Simple Program

Unit IV:	**Improper Integrals:**	**[12 Periods]**

Beta and Gamma integrals - properties – problems -relation between Beta and Gamma functions- Scilab Simple Program

Unit V:	**Change of Variables:**	**[12 Periods]**

Jacobian - Change of variable in the case of two variables and three variables – Transformation from Cartesian to polar coordinates – Spherical polar co-ordinates -- Scilab Simple Program

Text Books:

Narayanan S. and Manicavasagam Pillay T. K, Calculus Volume - I, S. Viswanathan Pvt. Ltd, 2010.

Narayanan S. and Manicavasagam Pillay T. K, Calculus Volume - II, S. Viswanathan Pvt. Ltd, 2010.

Introduction to Scilab: For Engineers and Scientists, Sandeep Nagar, Apress, First edition, 2018.

Content

Unit I	Textbook 1	Chapter 3	Section 10.2.1-10.3.1
	Textbook 3	Chapter 1, 2, 3 & 4	
Unit II	Textbook 2	Chapter 1	Section 1.1.1-1.15.1
Unit III	Textbook 2	Chapter 5	Section 5.1-5.3.2 & 5.4-5.5.4
Unit IV	Textbook 2	Chapter 7	Section 7.1.1-7.5
Unit V	Textbook 2	Chapter 6	Section 1.1,1.2 & 2.1-2.4

Reference Books:

Calculus(2nd Edition), Lipman Bers and Frank Karal, Holt McDougal, 1976.

Thomas' Calculus 12th Edition, George B.Thomas, Maurice D.Weir and Joel Hass, Pearson Education, 2015.

Integral Calculus, N. P. Bali, Laxmi Publications, Delhi, (1991)

Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013

N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010

Advanced Programming in SciLab, Chetana Jain , Alpha Science International Ltd. (2020).

Scilab: A Hands on Introduction by Satish Annigeri.

Programming in Scilab 4.1, Vinu V. Das, New Age International Publisher, First edition,2008.

Programming using Scilab: Theory and Practicals Book by Akhilesh Kumar.

Web Resources:

www.scilab.org

https://www.khanacademy.org/math/calculus-1

https://ocw.mit.edu/courses/18-01sc-single-variable-calculus-fall-2010/

https://onlinecourses.nptel.ac.in/noc21_ma16/preview

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	2	3	3		3	1				1	1	2	3		2
CO2		2		2	3	2	1	2	1	1	1	1	2		3	
CO3	3		2			1	3	2		1		1		3		2
CO4	3	1	2		3		2			2	2	2	2	2	1	3
CO5	1	2	3	2		2	1				2		1	2	3	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Statistical Foundation of Data Analytics – I	4	5	-	-	Allied Theory

Course Introduction

This course provides students with a comprehensive introduction to fundamental statistical concepts, coupled with practical applications using the Statistical Package for the Social Sciences (SPSS).

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	To comprehend and utilize statistical terminology, principles, and methodologies effectively.
CO 2:	To craft precise problem statements and devise suitable data collection tools.
CO 3:	To evaluate data employing measures of centrality, variability, and categorization approaches.
CO 4:	To interpret connections within datasets through correlation analysis methods.
CO 5:	To explore and dissect associations between variables using regression modelling.

Unit I:	**Foundations of Data Collection**	**[12 Periods]**

Basic Concepts on Population- Sample- Sampling unit- Sample Size and its Determination-Steps in Sample design- Selecting the Problem and necessity of defining the Problem -Designing a questionnaire and a schedule for collecting data for a set of objectives under study with illustrated examples- Methods for collecting Primary and Secondary data and their merits and demerits

Unit II:	**Data Visualization Techniques**	**[12 Periods]**

Graphical computation of Data and Interpretation: Histogram, frequency curve, frequency polygon, ogive curves-Diagrammatic computation of Data and Interpretation: Bar diagrams (simple, component, multiple, percentage Bars), Pie diagram-Classification and Tabulation of data- Data Interpretation techniques, Precaution in Interpretation-Data interpretation problems.

Unit III:	**Descriptive Statistics**	**[12 Periods]**

Measures of central tendency – Mean, Median, and Mode - Measures of Dispersions – Range, Quartile Deviation, Standard Deviation, Variance. (Simple Problems)

Unit IV:	**Correlation Analysis**	**[12 Periods]**
Meaning – Definition - Types of Correlation –Significance of the study of correlation – Types of Correlation –Methods- Scatter Diagram – Graphic Method- Karl Pearson Coefficient of Correlation – Rank Correlation (Simple problems)		
Unit V:	**Advanced Regression Techniques**	**[12 Periods]**
Definition- Regression Lines – Regression Equation of Y on x , X on Y(Simple problems) – Uses of Equation -Advanced regression techniques (Multiple, Quadratic, and Logistic regression) Concepts only - Difference between correlation and regression.		

Text Books:

1. S.P. Gupta, Statistical Methods, Sultan Chand &Sons, Educational Publishers, New Delhi, 2015.

2. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan Chand &Sons, Educational Publishers, New Delhi, 2011

3. Samprit Chatterjee, Ali S. Hadi, Regression Analysis by example, A John Wiley & Sons, inc., publication

Contents:

Unit I	Textbook 1	Chapter – 2	Page number: 2.1 – 2.11
		Chapter – 3	Page number: 3.1 – 3.19
		Chapter – 4	Page number: 4.1 – 4.22
Unit II	Textbook 1	Chapter – 5	Page number: 5.1-5.30
		Chapter – 6	Page number: 6.1 – 6.46
Unit III	Textbook 1	Chapter-7	Page number: 7.1-7.78
		Chapter-8	Page number: 8.1 – 8.62
Unit IV	Textbook 2	Chapter – 10	Page number: 10.1-10.44
Unit V	Textbook 3	Chapter – 2	Page number: 25-35
		Chapter – 3	Page number: 57-79
		Chapter – 12	Page number:335-355

Reference Books:

1. S.C. Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.

2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.

3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.

Web Resources:

https://www.youtube.com/watch?v=yOU_s0xzc-Y

https://www.indeed.com/career-advice/career-development/methods-of-data-collection

https://www.khanacademy.org/math/probability/xa88397b6:scatterplots/estimating-trend-lines/v/correlation-and-causality

Shttps://www.youtube.com/watch?v=ackPRB8_QBI

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2						1		1		1	3			
CO2	3			2		3				1	1	1	3			
CO3		3		2						1		1		3		
CO4			3	2							2				3	
CO5		3			3			2		1	2	1				3

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	SPSS Programming	4	-	-	4	Skill Enhancement Course

Course Introduction

This course provides students learn the essential statistical concepts and techniques using SPSS.

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	To describe the key terminology, concepts, tools and techniqu
CO 2:	To develop a concise and clear description of a statistical problem.
CO 3:	To analyze statistical data using measures of central tendency, dispersion and location.
CO 4:	To use probability distributions to describe the behavior of discrete and continuous random variables.
CO 5:	To investigate relationships between variables using regression models.

Unit I:	**Differential Calculus and Introduction to Scilab**	**[12 Periods]**
pen SPSS data file – save-import from other data source – data entry – labelling for dummy numbers – recode into same variable-recode into different variable-transpose of data- insert varia ble and cases- merge variables and cases		
Unit II:	**Integral Calculus:**	**[12 Periods]**
Data handling : Split – select cases- compute total scores- table looks – changing column – font style and size. Diagrammatic representation:simple bar diagrams-multiple bar diagram-sub divided bar diagram-Percentage bar diagram- Pie diagram- Scatter diagram- Histogram		
Unit III:	**Multiple Integrals:**	**[12 Periods]**
Descriptive Statistics: Mean,Median ,Mode,SD-Skewness – Kurtosis.Correlation :Karl pearson's and Spearman's rank correlation .		
Unit IV:	**Improper Integrals:**	**[12 Periods]**
Regression analysis: Simple and Muliple regression analysis (Enter and stepwise methods)-		

Forward selection regression and backward selection regression - Quadratic regression.		
Unit V:	**Change of Variables:**	**[12 Periods]**
Testing : parametric – one sample – two sample independent t -test-paried t- test-Non paramtereic: One sample KS test – Mann Whitney u test- Wilcoxon Signed rank test- Chisquare test. ANOVA : One way and Two way ANOVA		

Text Books:

1. SPSS for statrter(2010)-Ton J Cleophas, AeikoH.Zwinderman
2. How to use spss Statistics- A Step by Step guide to analysis and interpretation- Brain C.Cronk
3. SPSS Statistics for Dummies, 3rd edition-Keith Mccormick, Jesus Salcedo, Aron poh

Reference Books:

1. Statistical Analysis using SPSS- KaruthanChinna, krishnkumarikaruthan.
2. SPSS for you – A.Rajathi,P.Chandran, MJP Publishers

Web Resources:

1. https://www.youtube.com/watch?v= zFBUfZEBWQ
2. https://www.youtube.com/watch?v=TZPyOJ8tFcI
3. https://www.linkedin.com/advice/0/how-do-you-use-spss-data-analysis-interpretation#:~:text=SPSS%20offers%20a%20wide%20range,and%20requirements%20of%20each%20method.
4. https://www.youtube.com/watch?v=ZEJ-ge5bY7Y
5. https://surveysparrow.com/blog/what-is-spss/

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2		2		1	1	1	2		1	1	3			
CO2	3	3					2	1	2	1	1	1	3			
CO3		3	3			2		3		1	2	1		3	3	
CO4		2	2	3		3			1	2	2	2		3	3	
CO5					3	2		3	1		2	1				3

Semester-II

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Trigonometry, Vector Calculus and Fourier series	4	5	-	-	Core Theory

Course Introduction

This paper enables the students to learn expansions of trigonometric functions, hyperbolic functions, inverse hyperbolic functions and it aims to develop computational skills

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will able
CO 1:	To develop and understand the nature of trigonometric functions
CO 2:	To demonstrate the concept of several trigonometric identities and use them to verify other identities.
CO 3:	To determine the concepts of differential and integral calculus to solve multiple integrals.
CO 4:	To evaluate trigonometric and inverse trigonometric functions.
CO 5:	To understand the concepts of Fourier analysis to half range series.

Unit I:		**[12 Periods]**
Expansions of cosnθ, sinnθ and tan nθ -Expansion of $\cos^n\theta$, $\sin^n\theta$ -hyperbolic functions and inverse Hyperbolic functions.		
Unit II:		**[12 Periods]**
Logarithm of complex quantities-Summations of trigonometric series -Simple problems.		
Unit III:		**[12 Periods]**
Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl.		
Unit IV:		**[12 Periods]**
Line integral-surface integral- volume integrals- Gauss, Green & Stokes theorem (Statement only).		
Unit V:		**[12 Periods]**
Fourier series- The Cosine and Sine series- Even and Odd functions- Half range series		

Text Books:

1. T.K. Manichavasagam Pillai and S.Narayanan," Trigonometry", Viswanathan Publishers and Printers Pvt. Ltd,2013.[Unit I&II]

2. P.Duraipandian and KayalalPachaiyappa," Vector Calculus", Muhil Publishers, 2009. [Unit III &IV].

3. P.R.Vittal. (2004) Vector Calculus, Fourier series and Fourier Transform. Margham Publications, Chennai. [Unit V]

Contents:

Unit I	Chapter-3	Page Number: 61-66, 77-83,
	Chapter-4	Page Number: 93-105.
Unit II	Chapter-5	Page Number: 122 -141.
Unit III	Chapter-1, 2, 3	Page Number: 1-65
Unit IV	Chapter-5&6	Page Number: 98-204.
	Chapter-4	Page Number: 57-97.
Unit V	Chapter -2	Page Number: 6-43.

Reference Books:

Kandasamy. P, Thilagavathi. K, " Mathematics for B.Sc. Branch I", Volume I II and IV - S.Chand and Company Ltd, New Delhi, 2004.

P. Duraipandian and LaxmiDuraipandian, " Vector Analysis", Emerald Publishers, 2003.

Web Resources:

https://www.youtube.com/watch?v=kqlLfBxPcUo

https://www.youtube.com/watch?v=Wkil_7WTToY

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		2		1				3		1	1	1	3	3		
CO2	1		3			2		3		1	1		3	2		
CO3		1		2		2	3				2	1	1	1		
CO4			1	3	2	3		3		2		2	1	1		
CO5		2		1			2		3		2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Analytical Geometry using Geogebra	4	4	-	-	Core Theory

Course Introduction

This paper enables the students to learn the various properties of geometrical figures in two dimension and three dimensions

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will be able
CO 1:	To develop and understand the nature and purpose of two dimension and three dimensions.
CO 2:	To understand the differences of 2D and 3D geometrical shapes.
CO 3:	To acquire knowledge of representing conics in polar co-ordinates.
CO 4:	To construct the models based on Sphere, Cone and Cylinder.
CO 5:	To apply the concepts of Sphere, Cone and Cylinder in real world.

Unit I:	**Analytical geometry of 2D**	**[12 Periods]**

Analytical geometry of 2D-Polar Equations -directrix- chord tangent- normal- Problems..

Unit II:	**Analytical Geometry 3D**	**[12 Periods]**

Analytical Geometry 3D-straight lines-co planarity of straight-line-shortest distance (S.D) And equation of S.D between two lines.

Unit III:	**Sphere**	**[12 Periods]**

Sphere: Equation of a sphere – Tangent line - Tangent plane – Sections of the sphere- equation of a circle.

Unit IV:	**Cone and cylinder**	**[12 Periods]**

Cone and cylinder: Equation of a Cone -right circular cone- Equation of a cylinder- right circular Cylinder.

Unit V:	**Introduction to Scilab**	**[12 Periods]**

Introduction to Scilab- Installation process -Scilab functions-Features of Scilab- plotting -plotting Vectors 2D&3D.

Text Books:

1.P. DuraiPandian &Kayalal Pachaiyappa, "Analytical Geometry 2D", Emerald Publishers, Chennai. 2009.[Unit I].

2. P. DuraiPandian & Kayalal Pachaiyappa, "Analytical Geometry 3D", Emerald Publishers, Chennai. 2009. [Unit II to Unit IV].

3. Er. Hema Ramachandran and Achuthsankar S Nair "Scilab (A free Software to Matlab)" 1st edition S.Chand and Company 2015

4. Lecture notes/Lab manual/Tutorials on Sci Lab.

Contents:

Unit I	Chapter-10	Section 10.1 – 10.8
Unit II	Chapter-4	Section 4.1-4.2, 4.6, 4.8, 4.9, 4.12
Unit III	Chapter-5	Section 5.1-5.2, 5.4
Unit IV	Chapter-6	Section 6.1, 6.2, 6.3, 6.5, 6.6, 6.7
Unit V	Chapter-3	

Reference Books:

1. T.K. M. Pillai and Others "Analytical Geometry of 2D "– Viswanathan Publications- 2010

2. T.K. M. Pillai and Others "Analytical Geometry of 3D" – Viswanathan Publications- 2009

3. Johnny Heikell Scilab for real Dummies http://www.heikell.fi/download /scilab pdf.pdf

Web Resources:

1. https://www.youtube.com/watch?v=nu1_FEyoYgk

2. https://www.youtube.com/watch?v=1V_vB8lJQ1w

3. https://www.youtube.com/watch?v=lJbeINHrjHk

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	2			3		3				1	3	2	3	3
CO2	1	1		1		2			3			2	3	2	2	2
CO3	1	2			2		3	2				2	3	3	2	3
CO4		1		2		3			3			1	1	1		
CO5		1		2		3		3			2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Course Code	Couse Title
	Statistical Foundation of Data Analytics-II	4	5	-		**Statistical Foundation of Data Analytics-II**

Course Introduction

This paper enables the students to learn the basic skills of solving very common problems which we come across in various fields like transportation, sequencing and industries with machines.

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will able
CO 1:	To identify and demonstrate appropriate sampling and data collection processes.
CO 2:	To understand the basic principles underlying statistical inference.
CO 3:	To learn about the concept of hypothesis testing and distributions.
CO 4:	To define and demonstrate the concepts of estimation and properties of estimators.
CO 5:	To identify the type of statistical situation to which different distributions can be applied.

Unit I:	**Testing of Hypothesis**	**[12 Periods]**

Testing of Hypothesis: Statistical hypothesis - simple and composite hypothesis, Null and Alternative Hypothesis – Sample and Parameter Space – Two Types of errors – Critical Region - Power Test(Concept only). Test of significance - exact tests based on t, chi-square and F distributions.

Unit II:	**Multi variate Data analysis techniques**	**[12 Periods]**

Multi variate Data analysis techniques: Analysis of variance; one way, two way classifications, Total sum of squares, between sum of squares and within sum of squares – Assumptions - ANOVA Table.

Unit III:	**Non Parametric Test**	**[12 Periods]**

Non Parametric Test: Non-parametric methods, Basic distribution, Wold-Wolfowitz run test, Test

for randomness, Median Test, Sign test, Mann-Whitney-Wilcoxon U-test.

Unit IV:	**Census and Sampling**	**[12 Periods]**

Census and Sampling: Principal steps in a sample survey, different types of sampling, Organization and execution of large scale sample surveys, errors in sampling (Sampling and non sampling errors) simple random sampling, Systematic, Stratified sampling (Theory only).

Unit V:	**SPSS**	**[12 Periods]**

Perform test using SPSS – Test of Hypothesis - ANOVA – Non parametric test.

Text Books:

1. S.P.Gupta, Statistical Methods, Sultan Chand &Sons, Educational Publishers, New Delhi, 2015.

2. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan Chand &Sons, Educational Publishers, New Delhi, 2011.

Contents:

Unit I	Chapter-3	Page Number: 881-913.
	Chapter-4	Page Number: 954-1000.
Unit II	Chapter-5	Page Number: 1004 -1006.
Unit III	Chapter-5	Page Number: 1009-1038.
Unit IV	Chapter-11	Page Number: 1160-1171.

Reference Books:

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.

2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.

3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.

4. N.P. Bali, Statistics (Maths Series), Laxmi Publications pvt.Ltd, New Delhi.

Web Resources:

https://www.youtube.com/watch?v=UXV-A0Zo1Jk

https://www.youtube.com/watch?v=r1ueoHA_KCQ

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		2				3	2		1	1	1	3	3		

CO2	1	1	2					3		1	1		3	2		
CO3		1		2		2	3				2	1	1	1		
CO4		2		1		3	2		3	2		2	1	1		
CO5	1		2		2			3			2		1	1		

Semester III

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Differential Equations	4	6	-	-	Core Theory

Course Introduction

This paper enables the students to develop the knowledge of standard concepts of

Ordinary differential equations and apply analytical techniques to compute solutions to various differential equations.

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	To develop ability to solve exact differential equations.
CO 2:	To gain knowledge to solve first-order ordinary differential equations.
CO 3:	To compare the effectiveness of Ordinary and Partial differential equations
CO 4:	To develop problem solving techniques using differential equations
CO 5:	To learn the essentials and methods of solving differential equations and PDE

Unit I:	**Ordinary Differential Equations**	**[12 Periods]**

Ordinary Differential Equations- Differential Equations their formation and solutions: order-degree-linear and nonlinear - implicit and explicit form of solution - general solutions - particular solution - singular solution. Exactness, non-exact equations reduce to exact form. Equations of first order but of higher degree: Equations solvable for y, x- simple problems

Unit II:	**Equations of Second order**	**[12 Periods]**

Equations of Second order: Linear homogeneous differential equations with constant coefficients, Euler- Cauchy equation, Linear Nonhomogeneous Differential Equations: Wronskian, linear independence, Method of undetermined coefficients- simple problems.

Unit III:	**Systems of first order linear equations**	**[12 Periods]**

Systems of first order linear equations: Conversion of nth order differential equation to n first order differential equations, homogeneous linear system with constant coefficients, simultaneous linear differential equations with constant coefficients, simultaneous linear differential equations with variable coefficients- simple problems

Unit IV:	**Partial Differential Equations**	**[12 Periods]**

Partial Differential Equations: Origin of partial differential equations - order - degree - linear-nonlinear Formation of equations by eliminating arbitrary constants and arbitrary functions. Solutions of partial differential equations: General, particular and complete integrals. Lagrange's linear equation-simple problems

Unit V:	**Classification of partial differential equations of second order**	**[12 Periods]**

Classification of partial differential equations of second order. Homogeneous linear partial differential equations with constant coefficient of higher order- simple problems.

Text Books:

M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand, 18th edition, 2016.

Contents:

Unit I : Part I: 1.1-1.9, 2.12-2.22 and Part I: 4.1-4.7

Unit II : Part I: 5.1-5.5, 6.1-6.3, 1.12,1.13, 5.26-5.27

Unit III : Part I: 8.1-8.3, 2.1- 2.7

Unit IV: Part III: 1.1 – 1.5, 2.3-2.12, 3.1-3.2

Unit V: Part III: 8.1, 4.1-4.12

Reference Books:

1. William E. Boyce and Richard C. DiPrima, Elementary differential equations and boundar value problems, Wiley india, 9th edition, 2012.

2.Nita H, Shah, Ordinary and Partial Differential Equations: Theory and Applications, PHI learning, 2nd edition, 2015.

3. Dennis Zill, A First Course in Differential Equations, Cengage Learning, 9th edition, 2009

Web Resources:

1. https://www.youtube.com/watch?v=ngN2vzywW08&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc
2. https://www.youtube.com/watch?v=YN4jPQvjdSA&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=2
3. https://www.youtube.com/watch?v=0gXE9986V-U&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=4

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outc	**Programme Outcomes**												**Programme Specific Outcome**			
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO	PSO

ome	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2
CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Financial Accounting I	4	5	-	-	Allied Theory

Course Introduction

Introduction:

This paper enables the students to understand the concept of metric spaces, concept of metric spaces and Riemann Integral spaces

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Describing the concepts based on depreciation and its methods in books ofaccounts.
CO 2:	Outline about the nature of Investment and Royal excluding Sublease.
CO 3:	Identifying the essential characteristics of single entry system.
CO 4:	Applying the basic concepts of departmental and branch accounting.
CO 5:	Familiarize the procedure relating to hire purchase and installment in books of accounts

Unit I:	Accounting for depreciation	[12 Periods]

Accounting for Depreciation – Depreciation Meaning- Causes -need and significance of depreciation- methods of providing depreciation- Straight line, Written down Value, Annuity,Sinking fund (Excluding changing method of Depreciation). Reserves and Provision

Unit II:	Single Entry Sstem	[12 Periods]

Single Entry system-meaning and features-Statement of affairs method and Conversion method

Unit III:	Departmental Accounts	[12 Periods]

Departmental accounts – transfers at cost or selling price –Branch excluding foreign branches

Unit IV:	Hire purchase	[12 Periods]

Hire purchase and instalment systems including Hire Purchasing Trading account- Goods onsaleor Return

Unit V:	Royalty including sublease	[12 Periods]

Royalty including Sublease - Human Resource Accounting and Inflation Accounting

(Theory only).

Text Books:

Advanced Accountancy - R.L.Gupta & M.Radhasamy

Reference Books:

1.Advanced Accountancy - M.C.Shukla & T.S.Grewal

2.Finanacial Accounting - T.S.Reddy & A.Murthy

Web Resources:

https://nios.ac.in/media/documents/Seccouí224New/ch_12.pdf

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2
CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Programming with C++	4	-	-	5	Skill Enhancement Course

Course Introduction

This paper enables the students to learn about the applicability of OOPs concept with the help of C++.

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will able
CO 1:	To understand dynamic memory management techniques using pointers, constructors and destructors.
CO 2:	To describe the concept of function overloading, operator overloading and virtual functions
CO 3:	To apply inheritance, usage of exception handling, generic programming.
CO 4:	To describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
CO 5:	To demonstrate the use of various OOPs concepts with the help of programs.

Unit I:	**OOPS**	**[12 Periods]**
OOPS: A New Paradigm – Evaluation of Programming Paradigm – Objects – Classes –– OOPs Languages –Application of OOPs.		
Unit II:	**Application of C++**	**[12 Periods]**
Application of C++ - Structure of C++ Program – Tokens, Expression -Basic Data Types –Symbolic Constants – Operator in C++ - Function.		
Unit III:	**Array of objects**	**[12 Periods]**
Array of Objects – Friend Function -Pointer to Members –– Operator Overloading and Type Conversions – Overloading – Function Overloading – Special Features of Function Overloading.		
Unit IV:	**Inheritance**	**[12 Periods]**
Inheritance – Single Inheritance –public - Private – Protected Inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Polymorphism – Virtual Functions		
Unit V:	**C++ Streams**	**[12 Periods]**
C++ Streams – Stream Classes -Unformatted I/O Operation – Managing Console I/O Operations -		

Classes for File Stream Operations – Opening and Closing a file.

Text Books:

1. E.Balagurusamy - 'Object Oriented programming with C++', 4th edition, McGraw Hill Publishing Company Limited, 2006.

Contents:

Unit – I : Chapter 1: Sections 1.1 – 1.8

Unit – II : Chapter 2: Sections 2.1 – 2.6

Chapter 3: Sections 3.1 – 3.24

Chapter 4: Sections 4.1 – 4.11

Unit – III: Chapter 5: Sections 5.4 – 5.19

Chapter 7: Sections 7.1 – 7.8

Unit – IV : Chapter 8: Sections 8.1 – 8.12

Unit – V: Chapter 10: Sections 10.1 – 10.6

Chapter 11: Sections 11.1 – 11.3

Reference Books:

1. Ashok N.Kamthane – 'Object Oriented Programming with ANSI and Turbo C++', Pearson

2. D.Ravichandran, "Programming with C++", Tata McGraw-Hill Publishing CompanyLimited, New Delhi, 2002.

Web Resources:

https://www.youtube.com/watch?v=ZzaPdXTrSb8

https://www.youtube.com/watch?v=VkGjhmWXFsQ

https://www.youtube.com/watch?v=pTB0EiLXUC8

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3		2				3	2		1	1	1	3	3		
CO2	1	1	2					3		1	1		3	2		
CO3		1		2		2	3				2	1	1	1		
CO4		2		1		3	2		3	2		2	1	1		
CO5	1		2		2			3			2		1	1		

Semester IV

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Mechanics	4	6	-	-	Core Theory

Course Introduction

Introduction:

This course enables the students to understand the concept of series, sequences of complex numbers and various applications of residues.

Course Focus on: Skill Development/ **Entrepreneurship** / Employability / Research

Course Outcomes	On completion of this course, students will able
CO 1:	To Understand Resultant, Component of a Force, Coplanar forces, like and unlike parallel forces, Equilibrium of a Particle, Limiting equilibrium of a particle on an inclined plane .
CO 2:	To Examine the concepts of Moment of a force and Couple with examples. Examine Parallel Forces and Forces acting along a Triangle, Solve problems on frictional forces
CO 3:	To understand work, energy, power, rectilinear motions under varying forces. Define Simple Harmonic Motion and find its Geometrical representation.
CO 4:	To analyze Projectile, impulse, impact and laws of impact. Prove that the path of a projectile is a parabola. Find the direct and oblique impact of smooth elastic spheres
CO 5:	To Define central orbits, explain conic as centered orbits and solve problems related to central orbits

Unit I:	**Force**	**[12 Periods]**

Force: Newton's laws of motion – Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane.

Unit II:	**Forces on a Rigid Body**	**[12 Periods]**

Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Problems involving frictional forces.

Unit III:	**Work, Energy and Power**	**[12 Periods]**

Work, Energy and Power: Work – Conservative field of force – Power -Rectilinear Motion under Varying Force: Simple Harmonic Motion - along a horizontal line – along a vertical line.

Unit IV:	**Projectiles**	**[12 Periods]**

Projectiles: Forces on a projectile – Projectile projected on an inclined plane

Unit V:	**Central Orbits**	**[12 Periods]**

Central Orbits: General orbits – Central orbit – Conic as a centered orbit

Text Books:

1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, Oxford University Press, 2014.

2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.

Contents:

Unit I : Chapter 5

Unit II: Chapter 5

Unit III: Chapter 6

Unit IV: Chapter 7

Unit V: Chapter 7

Reference Books:

1. J.L. Meriam and L. G. Kraige, Engineering Mechanics: Statics, Seventh Edition,Wiley and sons Pvt ltd., New York, 2012.

2. J.L. Meriam, L. G. Kraige, and J.N. Bolton, Engineering Mechanics: Dynamics, 8thedn, Wiley and sons Pvt ltd., New York, 2015.

3. A. K. Dhiman, P.Dhinam and D. Kulshreshtha, Engineering Mechanics (Statics and Dynamics), McGraw Hill Education(India) Private Limited, New Delhi, 2015

Web Resources:

1. https://www.youtube.com/watch?v=u5yywGvUHYM
2. https://www.youtube.com/watch?v=7SiW_x3cUBo
3. https://www.youtube.com/watch?v=lQIbcV6dQzw

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2		1			3		2		1	3	2	3	3
CO2		3				2			3			2	3	2	2	2
CO3	3	3			2		3	2		3		2	3	3	2	3
CO4		1		2		3			3			1	1	1		

CO5	1						3			1	2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Linear Algebra	4	4	-	-	Core Theory

Course Introduction

This course enables the students to understand the concept of Vector spaces, linear equations and linear transformations.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will be able
CO 1:	To explain the basic concepts of Vector spaces.
CO 2:	To examine the concept of linear transformations and its characteristics.
CO 3:	To understand the concept of Inner product space.
CO 4:	To demonstrate the concept of determinants.
CO 5:	To make use of the concept of determinants and developing knowledge about diagonalization.

Unit I:	**Vector Spaces**	**[12 Periods]**

Vector Spaces: Definitions and Examples- Vector Subspaces-Basics and dimension of a vector spaces-Quotient spaces

Unit II:	**Linear Transformations**	**[12 Periods]**

Linear Transformations: Linear Transformations-Representatives of a linear maps and matrices-Kernal and image transformations-Some special linear transformations

Unit III:	**Inner Product Space**	**[12 Periods]**

Inner product space: Orthogonality- Orthonormal basis-Orthogonal complements and projections-Orthogonal transformation.

Unit IV:	**Determinants**	**[12 Periods]**

Determinants: 2 X 2 determinants as area of a parallelogram- Determinants and properties-Computation of determinants- Basics results on determinants.

Unit V:	**Determinants**	**[12 Periods]**

Determinants: Orientations and vector product. Diagnolization: Eigen values and Eigen Vectors-Diagonalization of symmetric matrices- The singular value decomposition

Text Books:

1 S.Kumaresan, "Linear Algebra", Second Edition, PHI Learning Pvt. Ltd, New Delhi, 2017.

Contents:

Unit I : Chapter 2 and 3.

Unit II : Chapter 4.

Unit III: Chapter 5: Sections: 5.2,5.5,5.6,5.8.

Unit IV: Chapter 6: Sections:6.1,6.2,6.3,6.4.

Unit V: Chapter 6: Sections: 6.5, Chapter 7: 7.2, 7.3.

Reference Books:

B. S. Vatssa," Theory of matrices", Willey Eastern Limited,1995.

I.N. Herstein," Topics in algebra", John Wiley Son (ASIA) Pvt Ltd,Second Edition,2004.

Web Resources:

https://www.youtube.com/watch?v=EP2ghkO0lSk

https://www.youtube.com/watch?v=Qwu8uY-7-2M&list=PLZSrM0Ajr9iQZ3J9ZjrA_W_yeF--R7ch8

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2		1	1				1	3	2	3	3
CO2	3	3	2	2	1			1				2	3	2	2	2
CO3	3	3	3	1	1			1				2	3	3	2	3
CO4	3	3	3	3	3		2	1				1	1	1		
CO5	1		2		2			3			2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Financial Accounting-II	4	5	-	-	Allied

Course Introduction

Introduction:

This paper enables the students to understand the concept of metric spaces, concept of metric spaces and Riemann Integral spaces

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will
CO 1:	To evaluate the Hire purchase accounts and Instalment systems
CO 2:	To prepare Branch accounts and Departmental Account
CO 3:	To understand the accounting treatment for admission and retirement in partnership
CO 4:	To know Settlement of accounts at the time of dissolution of a firm.
CO 5:	To elaborate the role of IFRS

Unit I:	Hire Purchase and Instalment System	[12 Periods]

Hire Purchase System – Accounting Treatment – Calculation of Interest

- Default and Repossession - Hire Purchase Trading Account Instalment System - Calculation of Profit

Unit II:	Branch and Departmental Accounts	[12 Periods]

Branch – Dependent Branches : Accounting Aspects - Debtors system - Stock and Debtors system – Distinction between Wholesale Profit and Retail Profit – Independent Branches (Foreign Branches excluded) - Departmental Accounts: Basis of Allocation of Expenses – Inter-

Departmental Transfer at Cost or Selling Price.

Unit III:	Partnership Accounts – I	[12 Periods]

Partnership Accounts: –Admission of a Partner – Treatment of Goodwill

- Calculation of Hidden Goodwill –Retirement of a Partner – Death of a Partner

Unit IV:	Partnership Accounts – II	[12 Periods]

Dissolution of Partnership - Methods – Settlement of Accounts Regarding Losses and Assets – Realization account – Treatment of Goodwill – Preparation of Balance Sheet - Insolvency of a Partner – One or more Partners insolvent – All Partners insolvent - Garner Vs Murray – Accounting Treatment - Piecemeal Distribution – Surplus Capital

Method – Maximum Loss Method.

Unit V:	Accounting Standards for financial reporting	[12 Periods]

Objectives and Uses of Financial Statements for Users-Role of Accounting Standards - Development of Accounting Standards in India- Requirements of International Accounting Standards - Role of Developing IFRS- IFRS Adoption or Convergence in India- Implementation Plan in India- Ind AS- An Introduction - Difference

between Ind AS and IFRS.

Text Books:

1.Radhaswamy and R.L. Gupta: Advanced Accounting , Sultan Chand, New Delhi.

Reference Books:

1.Dr. S.N. Maheswari: Financial Accounting, Vikas Publications, Noida.

Web Resources:

https://www.slideshare.net/mcsharma1/accounting-for-depreciation-1

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2
CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Mathematical modeling	6	5	-	-	Allied Theory

Course Introduction

This paper enables the students to have brief knowledge about designing the mathematical models in terms of differential equations for given phenomena.

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	To recall the concepts of mathematical modeling in terms of differential equations.
CO 2:	To understand the idea about model design for given problems.
CO 3:	To analyze the procedure for physical phenomena.
CO 4:	To apply the design of models in terms of PDE.
CO 5:	To examine the various methods for obtain the models.

Unit I:		**[12 Periods]**

Simple Situations Requiring Mathematical Modeling - The Technique of Mathematical Modeling - Mathematical Modeling Through Differential Equations - Linear Growth and Decay Models - Non-Linear Growth and Decay Models - Compartment Models - Mathematical Modeling of Geometrical Problems Through Ordinary Differential Equations of first Order.

Unit II:		**[12 Periods]**

Mathematical Modeling In Population Dynamics - Mathematical Modeling of Epidemics Through Systems of Ordinary Differential Equations of first Order - Compartment Models through Systems of Ordinary Differential Equations - Mathematical Modeling In Economics Through Systems of Ordinary Differential Equations of first Order.

Unit III:		**[12 Periods]**

Mathematical Models in Medicine, Arms Race, Battles and International Trade In Terms of Systems of Ordinary Differential Equations - Mathematical Modeling of Planetary Motions - Mathematical Modeling of Circular Motion and Motion of Satellites - Mathematical Modeling through linear differential equations of second order.

Unit IV:		**[12 Periods]**

Mathematical Modelling through Difference Equations : Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory

Unit V:		**[12 Periods]**

Mathematical Modelling through Graphs : Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs

Text Books: 1. J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, New Delhi, 1988

Contents:

Unit 1:	Chapter 2,	Section 2.1 – 2.6
Unit 2:	Chapter 3,	Section 3.1 – 3.6
Unit 3:	Chapter 4,	Section 4.1 – 4.4
Unit 4:	Chapter 5,	Section 5.1 – 5.5
Unit 5:	Chapter 7,	Section 7.1 – 7.5

Web Resources:

1. https://www.youtube.com/watch?v=oHCth8058lk
2. https://www.youtube.com/watch?v=Wv2MgI2sFkM
3. https://www.youtube.com/watch?v=pcLASzMHr0E

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	3	2						1		1		1	3			
CO2	3			2		3				1	1	1	3			
CO3		3		2						1		1		3		
CO4			3	2							2				3	
CO5		3			3			2		1	2	1				3

Semester V

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Real Analysis-I	4	5	-	-	Core Theory

Course Introduction

This paper enables the students to learn the concept of real numbers and to analyze the properties of real numbers with its applications.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	To determine the basic topological properties of subsets of the real numbers.
CO 2:	To use the definitions of convergence as they apply to sequences, series, and functions.
CO 3:	To determine the continuity, differentiability, and integrability of functions defined on subsets of the real line.
CO 4:	To produce rigorous proofs of results that arise in the context of real analysis.
CO 5:	To evaluate the concept of Limits and Continuity to solve the problems.

Unit I:	**Functions**	**[12 Periods]**

Functions – Real Valued functions – Equivalence, countability – Real numbers – Least upper bound Sequence of real numbers – definition of sequence and subsequence – Limit of a sequence - Convergent sequences – divergent sequences.

Unit II:	**Bounded Sequences**	[12 Periods]

Bounded sequences – Monotone sequences – operations on convergent sequences – operations on divergent sequences – Limit superior and limit inferior – Cauchy sequences

Unit III:	**Convergent and divergent series of real numbers**	[12 Periods]

Convergent and divergent series of real numbers – series with non–negative terms – Alternating series – conditional convergence and absolute convergence – Rearrangements of series – Test for absolute convergence – series whose terms form a non - increasing sequence.

Unit IV:	**The Class l^2**	[12 Periods]

The Class l^2 – Limit of a function on the real line – metric spaces – Limit in metric spaces.

Unit V:	Functions continuous at a point on the real line	[12 Periods]

Functions continuous at a point on the real line – Reformulation – Functions continuous on a metric space – open sets – closed sets – Discontinuous functions on R1.

Text Books:

Richard R. Goldberg, Methods of Real Analysis – Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Contents:

Unit – I :	Chapter 1:	Sections 1.3 - 1.7
	Chapter 2:	Sections 2.1 – 2.4
Unit – II:	Chapter 2:	Sections 2.5 – 2.10
Unit – III:	Chapter 3:	Sections 3.1 – 3.7
Unit – IV:	Chapter 3:	Section 3.10
	Chapter 4:	Sections 4.1 – 4.3
Unit – V:	Chapter 5:	Sections 5.1 – 5.6

Reference Books:

D. Somasundaram and B.Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, Third Reprint, 2007.

2. Tom. M. Apostol, Mathematical Analysis, Narosa Publications, New Delhi, 2002.

Web Resources:

https://www.youtube.com/watch?v=ngN2vzywW08&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc

https://www.youtube.com/watch?v=YN4jPQvjdSA&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=2

https://www.youtube.com/watch?v=0gXE9986V-U&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=4

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2

CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	**Couse Title**	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Complex Analysis I	4	5	-	-	Core Theory

Course Introduction

This course enables the students to equip with necessary knowledge and skills for handling mathematical operations, analyses and problems involving complex numbers.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will be able
CO 1:	To understand algebraic and geometric structure of the complex number system
CO 2:	To illustrate the various elementary complex functions
CO 3:	To introduce the analytical functions
CO 4:	To develop the concept of a conformal mapping with emphasis connection to harmonic functions
CO 5:	To analyze the geometric interpretation of a complex function as a mapping or transformation.

Unit I:	**Complex Numbers**	**[12 Periods]**

Complex Numbers: Sum and Product-Algebraic Properties- Further Properties- Vector and Modulii- Complex Conjugates- Exponential Form- Product and Powers in Exponential Form- Arguments of Profuct and Quotients

Elementary Functions: The Exponential function – The Logarithmic functions – Some identities involving logarithms – Complex Exponents – Trigonometric functions – Hyperbolic functions – Inverse Trigonometric and Hyperbolic functions.

Unit II:	**Analytic functions**	**[12 Periods]**

Analytic functions: Limits – Theorems on Limit – Limits involving the point at infinity - Continuity- Derivatives and Differentiation Formula -Cauchy-Riemann equations –Sufficient Condition fort Differentiability-Polar Coordinates- Analytical Functions- Examples

Unit III:	**Harmonic Functions**	**[12 Periods]**
Harmonic functions –Preservation of angles-Harmonic Conjugates- Transformations of Harmonic Functions		
Unit IV:	**Mapping by Elementary Functions**	**[12 Periods]**
Mapping by Elementary functions: Linear transformations - The transformations $w = \frac{1}{z}$, mapping by $w = \frac{1}{z}$ – Linear Fractional Transformations- An Implicit form- Mapping of the upper half plane- The transformation $w = \sin z$- Mapping by $z^2$and branches of $z^{1/2}$.		
Unit V:	**Integrals**	**[12 Periods]**
Integrals: Contours – Contour Integrals –Upper Bound for Moduli of Contour Integral -Cauchy-Goursat's Theorem (without proof) – Cauchy's Integral Formula – An Extension of the Cauchy's Integral Formula- Liouville's Theorem and the Fundamental theorem of Algebra- Maximum Modulus Principle.		

Text Books:

R.V.Churchill and J.W.Brown, (1984) Complex Variables and Applications. McGraw Hill International Book Co., Singapore. (Third Edition)

Contents:

Unit I:	Chapter 1:	Sections 1-8
	Chapter 3	Sections 29-30, 32-36
Unit II:	Chapter 2:	Sections 15-25.
Unit II:	Chapter 2:	Section 26.
	Chapter 9:	Sections 101-105.
Unit III:	Chapter 8:	Sections 90-97.
Unit IV:	Chapter 4:	Sections 39-40, 43,46,50-51, 53-54.

Reference Books:

1. P. Duraipandian and LaxmiDuraipandian (1976) Complex Analysis: Emerald Publishers, Chennai

2. S. Ponnusamy. (2000) Foundations of Complex Analysis, Narosa Publishing House, New Delhi .Edition, New Delhi.

3. Murray R. Spiegel. (2005) Theory and Problems of Complex Variable. Tata-Mcgraw Hill Edition, New Delhi

Web Resources:

1. https://www.youtube.com/watch?v= mv0q7-WF4E
2. https://www.youtube.com/watch?v=Rp-smPZLESc
3. https://www.youtube.com/watch?v=59huv1T_LJw

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	**Programme Outcomes**												**Programme Specific Outcome**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1			2		1		2	3				1	3	2	3	3
CO2	1		3	2			2					2	3	2	2	2
CO3		1		3		3	3					2	3	3	2	3
CO4	2			2			2	2	3			1	1	1		
CO5	1		2			3		3			2		1	1		

Course Code	**Couse Title**	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Numerical Methods	4	5	-	-	Core Theory

Course Introduction:

This paper enables the students to learn numerical approximation strategies and a basic knowledge on the theory that supports numerical algorithms

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will
CO 1:	To demonstrate understanding of common numerical methods and how they are used

	to obtain approximate solutions to otherwise intractable mathematical problem
CO 2:	To apply numerical methods to obtain approximate solutions to mathematical problems
CO 3:	To analyse and evaluate the accuracy of common numerical methods
CO 4:	To analyse error obtained in the numerical solution of the problem
CO 5:	To apply numerical methods in modern scientific computing with finite precision computation.

Unit I:	Solutions of algebraic and transcendental equations	[12 Periods]

Solutions of algebraic and transcendental equations: Introduction -Bisection method- The Iteration method -False position method -Newton-Raphson Method- Ramanujan's method

Unit II:	Interpolation	[12 Periods]

Interpolation- Errors in Polynomial interpolation, Finite differences, Differences of a polynomial, Newton's forward and backward interpolation, Central differences, Gauss, Stirling, Bessel's and Everett's Formulae, Lagrange's Interpolation formula.

Unit III:	Linear systems of equations	[12 Periods]

Linear systems of equations: Consistency of Linear System of equations, Solutions of Linear Systems by direct method: Gaussian elimination, Gauss Jordan, solution of tridiagonal systems, Solutions of linear systems by iterative methods: Jacobi method, Gauss-Seidel method.

Unit IV:	Numerical integration	[12 Periods]

Numerical integration: Trapezoidal rule-Geometrical interpretation and error of Trapezoidal rule - Simpsons one third rule and three eighth rule formulae - Romberg integration

Unit V:	Numerical solution for ordinary differential equation	[12 Periods]

Numerical solution for ordinary differential equation-Solution of first order ODE by Taylor series method - Solution of first order ODE by Euler method- Error estimates for the Euler method –Modified Euler method - Runge Kutta method of second, third and fourth order.

Text Books:

1. Introductory Methods Numerical Analysis, S. S. Sastry Fifth Edition, Prentice- Hall Of India

Contents:

Unit I:	Chapter 2	Sections 2.1 -2.6
Unit II:	Chapter 3	Sections 3.2, 3.3 and 3.7, 3.9.1
Unit III:	Chapter 7	Sections 7.5.1, 7.5.3, 7.5.9 and 7.6

Unit IV:	Chapter 6	Sections 6.4.1-6.4.3, 6.4.6
Unit V :	Chapter 8	Sections 8.1, 8.2, 8.4 and 8.5

Reference Books:

Venkataraman M.K., "Numerical methods in Science and Engineering", National Publishing Company, Revised Edition, 2005.

2. Kandasamy P., "Numerical Methods", S.Chand and Co, Reprint 2010

3. M.K.Jain., Iyengar. S.R.K., Jain R.K., "Numerical Methods for Scientific and Engineering Computation", (6th Edition), New Age International, 2012.

Web Resources:

https://www.youtube.com/watch?v=JPSi-WCOhk4&list=PLoFGL7wppr4tdWBUS-wj-J1AHIVz21fTB

https://www.youtube.com/watch?v=11dQ5THsFlI&list=PLoFGL7wppr4tdWBUS-wj-J1AHIVz21fTB&index=3

https://www.youtube.com/watch?v=4m5AKnseSyI&list=PLoFGL7wppr4tdWBUS-wj-J1AHIVz21fTB&index=12

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2
CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Discrete	4	5	-	-	Core

	Mathematics					Theory

Course Introduction

Prepare students to develop mathematical foundations to understand , create mathematical arguments and focuses on the Formal languages , Automata, Lattices, Boolean Algebra and Graph Theory

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will be able
CO 1:	Determine properties of relations, identify equivalence and partial order relations, sketch relations
CO 2:	Analyze logical propositions via truth tables.
CO 3:	Understand sets and perform operations and algebra on sets.
CO 4:	To achieve greater accuracy , clarity of thought and language
CO 5:	Assimilate various graph theoretic concepts and familiarize with their applications

Unit I:	**Recurrence Relations and Generating functions**	**[12 Periods]**

Recurrence Relations and Generating functions: Recurrence - An introduction - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite order Homogeneous (linear) Relations - Solution of Non-homogeneous relations - Generating Functions - Some common recurrence relations

Unit II:	**Logic**	**[12 Periods]**

Logic: Introduction - TF-statements – Connectives - Atomic and Compound Statements - Well Formed (Statement) Formulae -The Truth table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae - Replacement Process - Functionally Complete Sets of Connectives and Duality Law - Normal Forms - Principal Normal Forms.

Unit III:	**Lattices and Boolean Algebra**	**[12 Periods]**

Lattices and Boolean Algebra: Lattices - Some properties of Lattices -New lattices - Modular and distributive lattices - Boolean Algebras

Unit IV:	**Language, Grammar and Automata**	**[12 Periods]**

Language, Grammar and Automata: Introduction - Language - The Set Theory of Strings - Languages - Regular Expressions and Regular Languages - Grammar - Finite-State Machine- Finite State Automata.

Unit V:	**Theory of Equations-II**	**[12 Periods]**

Graph Theory: Introduction - Basic Terminology - Paths, Cycles and Connectivity- Subgraphs - Types of Graphs - Isomorpic Graphs - Homeomorphic Graphs – Eulerian and Hamiltonian Graphs.

Text Books:

1.Sharma J. K," Discrete Mathematics", Macmillan Publishers India Ltd, 2011.

2.Venkataraman M. K, Sridharan N and Chandrasekaran N, "Discrete Mathematics", The National Publishing Company, 2000.

Content

Unit I - Chapter 8 :Sections : 8.1 to 8.8. [Text Book 1]

Unit II - Chapter 9 :Sections: 1 to 12. [Text Book 1]

Unit III - Chapter 10 :Sections: 1 to 5. [Text Book 1]

Unit IV - Chapter 9 :Sections: 9.1 to 9.7 and 9.9. [Text Book 2]

Unit V - Chapter 15 :Sections: 15.1 to 15.7. [Text Book 2]

Reference Books:

1.Ralph P. Grimaldi, "Discrete and Combinatoral Mathematics – An applied introduction", Third Edition, Addison Wesley Publishing Company, 1994.

2.Tremblay J. P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2001.

Web Resources:

1. https://www.youtube.com/watch?v=p2b2Vb-cYCs&list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3
2. https://www.youtube.com/watch?v=IZpvlR5J7FQ&list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3&index=2
3. https://www.youtube.com/watch?v=6kYngPvoGxU&list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3&index=4

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2			2				1	1	1	3	3		
CO2	3	1	3			3	3	3		1	1		3	2		
CO3	3	2	2	2		1	2				2	1	1	1		
CO4	3		1	2	1		1			2		2	1	1		

CO5	3		1	1	1		1				2		1	1		

Course Code	**Couse Title**	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Operations Research-I	4	5	-	-	Core Theory

Course Introduction

This paper enables the students to learn the basic skills of solving very common problems which we come across in various fields like transportation, sequencing and industries with machines.

Course Focus on: Skill Development/ Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will be able

CO 1:	To identify the goals and objectives of LPP and describe the procedure of solving LPP.
CO 2:	To develop the ability to handle the LPP equation to analyze the effect of objective function.
CO 3:	To understand the various methods of solving the Transportation Problem.
CO 4:	To understand how to reduce the cost value of the Assignment Problems.
CO 5:	To develop the sequence procedure for solving a real life problems.

Unit I:	**LPP**	**[12 Periods]**

LPP: Introduction- Linear Programming Problem – Formulation of L.P.P – Graphical solutions of L.P.P –Canonical & standard form of LPP- Simplex Method- Big-M Method

Unit II:	**Duality in LPP**	**[12 Periods]**

Duality in LPP: - Duality in Linear Programming - General primal-dual pair -

Formulating a Dual problem - Primal-dual pair in matrix form -Dual simplex method

Unit III:	**Transportation problem**	**[12 Periods]**

Transportation problem: Introduction- LP formulation of the TP - Solution of a TP - Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP – Transportation Algorithm (MODI Method).

Unit IV:	**Assignment Problem**	**[12 Periods]**

Assignment problem: Introduction- Solution methods of assignment problem – special cases in assignment problem.

Unit V:	**Sequencing Problem**	**[12 Periods]**

Sequencing Problem: Introduction- Problem of sequencing-processing n jobs through Two machines- processing n jobs through k machines- processing 2 jobs through k machines.

Text Books:

.Operations Research by Kanti Swarup , P.K.Gupta and Man Mohan, S. Chand & Sons Education Publications, New Delhi (2008).

Contents:

Unit I:	Chapter 2:	Sections 2.1 – 2.4,
	Chapter 3:	Sections 3.1 – 3.5, Sections 4.1-4.4
Unit 2:	Chapter 5 :	Sections 5.1 – 5.7, 5.9
Unit 3:	Chapter 10:	Sections 10.1 – 10.13
Unit 4:	Chapter 11:	Sections 11.1 – 11.7

Unit 5: Chapter 12: Sections 12.1-12.6

Reference Books:

1. Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, Resource Management Techniques, A.R. Publications, 2002.

2.Prem Kumar Gupta D. S. Hira, "Operations Research", S. Chand & Company Ltd, Ram Nagar, New Delhi.

3.S. Dharani Venkata Krishnan, "Operations Research Principles and Problems", Keerthi publishing house PVT Ltd.

Web Resources:

1. https://www.youtube.com/watch?v=drQM-lw4P2M
2. https://www.youtube.com/watch?v=Ow3XWYnPgSM&list=PLU6SqdYcYsfLdur9EvX7TXe0VeNgAdVtD
3. https://www.youtube.com/watch?v=pnJUzNFn3CA&list=PLU6SqdYcYsfLdur9EvX7TXe0VeNgAdVtD&index=4

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3		2				3	2		1	1	1	3	3		
CO2	1	1	2					3		1	1		3	2		
CO3		1		2		2	3				2	1	1	1		
CO4		2		1		3	2		3	2		2	1	1		
CO5	1		2		2			3			2		1	1		

Semester VI

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Real Analysis-II	4	5	-	-	**Core Theory**

Course Introduction
Introduction:

This paper enables the students to understand the concept of metric spaces, concept of metric spaces and Riemann Integral spaces

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	To acquire knowledge on open sets and metric spaces.
CO 2:	To determine the limit point of a series of functions.
CO 3:	To develop knowledge about Riemann Integration and apply into problems.
CO 4:	To understand various theorems associated with Riemann Integration.
CO 5:	To develop skill in checking the uniform and pointwise convergence of series.

Unit I:	**Sets**	**[12 Periods]**

More about open sets – connected sets – bounded sets and totally bounded sets – complete metric spac

Unit II:	**Compact metric spaces**	**[12 Periods]**

Compact metric spaces – continuous functions on compact metric spaces – continuity of the inverse function – uniform continuity.

Unit III:	**Sets of measure zero**	**[12 Periods]**

Sets of measure zero – Definition of the Riemann integral – Existence of the Riemann integral – Properties of the Riemann integral.

Unit IV:	**Derivatives**	**[12 Periods]**

Derivatives – Rolle's theorem – The law of the mean – Fundamental theorem of calculus

Unit V:	**Convergence sequence**	**[12 Periods]**

Pointwise convergence of sequences of functions – uniforms convergence of sequences of functions – consequences of uniform convergence – convergence and uniform convergence of series of functions.

Text Books:

1. Richard R. Goldberg, Methods of Real Analysis – Oxford and IBH Publishing co, Pvt. Ltd., New Delhi.

Contents:

Unit – I :	Chapter 6:	Sections 6.1 – 6.4
Unit – II:	Chapter 6:	Sections 6.5 – 6.8
Unit – III:	Chapter 7:	Sections 7.1 – 7.4
Unit – IV:	Chapter 7:	Section 7.5 – 7.8
Unit – V:	Chapter 9:	Sections 9.1 – 9.4

Reference Books:

1. D. Somasundaram and B.Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, Third Reprint, 2007.
2. Tom. M. Apostol, Mathematical Analysis, Narosa Publications, New Delhi, 2002.

Web Resources:

1. https://www.youtube.com/watch?v=ngN2vzywW08&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc
2. https://www.youtube.com/watch?v=YN4jPQvjdSA&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=2
3. https://www.youtube.com/watch?v=0gXE9986V-U&list=PLee24bbe4wKTdWQY7qEkc4fjTUcfs7Zgc&index=4

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2		2				1				1	3	2	3	3
CO2	3		2			3			3			2	3	2	2	2
CO3		3		1		2	2					2	3	3	2	3
CO4	3			3	1	1		3				1	1	1		
CO5		3		2			2	3					1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Complex Analysis II	4	5	-	-	Core Theory

Course Introduction
Introduction:

his course enables the students to understand the concept of series, sequences of complex numbers and various applications of residues.

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	To understand the series representation of analytical function.
CO 2:	To analyze the type of convergence of power series
CO 3:	To develop the theory of residues
CO 4:	To use power series and line integrals to construct differentiable functions.
CO 5:	To apply the theory of residues

Unit I:	**Convergences of Sequences**	**[12 Periods]**

: Convergences of Sequences – Convergences of Series – Taylor series – Proof of Taylor's Theorem – Examples – Laurent series – Proof of Laurent's theorem – Examples

Unit II:	Series	**[12 Periods]**

Series: Absolute and Uniform convergence of power series – continuity of sums of power series – Integration and differentiation of power series – Uniqueness of series representations – Multiplication and Division of power series.

Unit III:	Residues and Poles:	**[12 Periods]**

Residues and Poles: Singularities and classifications- Types of singularities – Zeros and Poles – Residues –Cauchy's Residue theorem-Residues at poles – Zeros of analytic functions – problems. .

Unit IV:	Applications of Residues	**[12 Periods]**

Applications of Residues: Evaluation of Improper Integrals – Examples – Improper Integrals from Fourier Analysis – Jordan's Lemma

Unit V:	**Integrals**	**[12 Periods]**

Definite Integrals Involving sines and cosines – Argument Principle – Rouche's Theorem.

Text Books:

1.R.V.Churchill and J.W.Brown, (1984) Complex Variables and Applications. McGraw Hill International Book Co., Singapore. (Third Edition).

Contents:

Unit I :	Chapter 5:	Sections 55-62.
Unit II:	Chapter 5:	Sections 63-67.
Unit III:	Chapter 6:	Section 68-76.
Unit IV:	Chapter 7:	Sections 78-81.
Unit V:	Chapter 7:	Sections 85-87.

Reference Books:

1. P. Duraipandian and LaxmiDuraipandian (1976) Complex Analysis: Emerald Publishers, Chennai.
2. S. Ponnusamy. (2000) Foundations of Complex Analysis, Narosa Publishing House, New Delhi.
3. Murray R. Spiegel. (2005) Theory and Problems of Complex Variable. Tata-Mcgraw Hill Edition, New Delhi.

Web Resources:

1. https://www.youtube.com/watch?v= mv0q7-WF4E
2. https://www.youtube.com/watch?v=Rp-smPZLESc
3. https://www.youtube.com/watch?v=59huv1T_LJw

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	2		1			3		2		1	3	2	3	3
CO2		3				2			3			2	3	2	2	2
CO3	3	3			2		3	2		3		2	3	3	2	3
CO4		1		2		3			3			1	1	1		
CO5	1						3			1	2		1	1		

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Graph Theory	4	5	-	**l**	**Core Theory**

Course Introduction

This paper enables the students to gain knowledge about graphs, trees, blocks, connectivity, reversibility, planarity and their properties

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course	On completion of this course, students will

Outcomes	
CO 1:	To recall the fundamental concepts of graph and its types.
CO 2:	To understand the characteristics of operation on graphs, trees and Fundamental circuits.
CO 3:	To apply the Concepts of Spanning Trees in graphs.
CO 4:	To analyze the concept of characterization in graphs.
CO 5:	To build the Matrix Representation of Graphs and Fundamental Circuit.

Unit I:	**Graph**	**[12 Periods]**

Graph – Applications of graphs- Finite and Infinite graphs – Incidence and Degree – Isolated vertex, Pendant vertex and Null graphs. Paths and Circuits: Isomorphism – Subgraphs – Walks, Paths and Circuits – Connected and disconnected graphs – Euler graphs.

Unit II:	**Operations on Graph**	**[12 Periods]**

Operations on Graphs – More on Euler graphs – Hamiltonian Paths and Circuits – Travelling Salesman Problem. Trees and Fundamental Circuits: Trees – Properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree..

Unit III:	**Spanning trees**	**[12 Periods]**

Spanning Trees – Fundamental Circuits – Finding all spanning trees of a graph - Spanning trees in a weighted graph .Cut sets and Cut vertices: Cut sets –Properties of a cut set – All cut sets in a graph.

Unit IV:	**Planar and Dual Graphs**	**[12 Periods]**

Planar and Dual Graphs: Planar graphs – Kuratowski's two graphs – Representation of a planar graph. Matrix Representation of Graphs: Incidence Matrix – Circuit Matrix – Fundamental Circuit Matrix and Rank of circuit matrix – Cut set matrix – Relationship among A_f, B_f and C_f – Path matrix.

Unit V:	**Basics on NetworkX**	**[12 Periods]**

Introduction – Installation - Basics on NetworkX - Creating a graph- Examining elements of a grap Adding attributes to graphs, nodes, and edges - Graph generators and graph operations - Analyzi graphs.

Text Books:

1. Narsingh Deo, "Graph theory with Application to Engineering and Computer Science", Prentice Hall of India Pvt. Ltd. (2011).

Contents:

Unit I:	Chapter 1:	Sections: 1.1- 1.5
	Chapter 2:	Sections: 2.1,2.2, 2.4- 2.6.
Unit II:	Chapter 2:	Sections: 2.7-2.10
	Chapter 3:	Sections: 3.1-3.4.
Unit III:	Chapter 3:	Sections: 3.7-3.10
	Chapter 4:	Sections: 4.1 -4.3.

Unit IV:	Chapter 5:	Sections: 5.2-5.4.

Reference Books:

1. R. Balakrishnan and K. Ranganathan, "A Text Book on Graph Theory", Springer Verlog, New York, 2000.

2. R.Gould, "Graph Theory", The Benjamin/ Cummings Publishing Company, Inc., California, 1988.

3. N. Hartsfield and G. Ringel, "Pearls in Graph Theory", Academic Press, 1990.

4. J.A. Bondy and U.S.R. Murty, "Graph Theory with Applications", Macmillan Company, 1976.

Web Resources:

1. https://www.youtube.com/watch?v=_mv0q7-WF4E
2. https://www.youtube.com/watch?v=Rp-smPZLESc
3. https://www.youtube.com/watch?v=59huv1T_LJw

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2		1	1				1	3	2	3	3
CO2	3	3	2	2	1			1				2	3	2	2	2
CO3	3	3	3	1	1			1				2	3	3	2	3
CO4	3	3	3	3	3		2	1				1	1	1		
CO5	1		2		2			3			2		1	1		

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Allied - Business Statistics	4	5	-	-	**Theory**

Course Introduction

This course enables the students to learn the Statistical methods and their applications in various fields.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able

CO 1:	To understand the fundamental concepts of statistical data and diagram
CO 2:	To apply the statistical tools in a appropriate way
CO 3:	To analyze the different types of statistical survey
CO 4:	To apply and interpret the results of Correlation and regression Analysis for forecasting.
CO 5:	To interpret and communicate the results of a statistical analysis in the context of a business problem.

Unit I:	**Introduction to statistics and Measures of Central tendency**	**[12 Periods]**

Meaning and Definition of Statistics – Collection of data — Primary and Secondary - Classification and Tabulation – Diagrammatic and Graphical presentation Measures of Central tendency – Mean, Median, Mode –simple problems.

Unit II:	**Measures of Dispersion**	**[12 Periods]**

Measures of Dispersion – Range, Quartile Deviation, Standard Deviation and Co-efficient of Variation.

Unit III:	**Correlation**	**[12 Periods]**

Correlation –Meaning and Definition – Karl Pearson's co-efficient of Correlation, Spearman's Rank Correlation. Regression Analysis – Regression in two variables – Coefficient of Concurrent Deviation.

Unit IV:	**Time Series**	**[12 Periods]**

Time Series – Meaning, Components and Models – Business forecasting – Methods of estimating trend – Graphic, Semi-average, Moving average – Seasonal Variation – Method of Simple average.

Unit V:	**Index Numbers**	**[12 Periods]**

Index Numbers – Meaning, Uses and Methods of construction – Un-weighted and Weighted index numbers – Tests of an Index number – Cost of living index number.
Interpolation: Binomial, Newton's. Method.

Text Books:

1. Navanitham, P.A," Business Mathematics & Statistics" Jai Publishers, Trichy-21(2015)
2. Statistics by R.S.N. Pillai and V. Bagavathi
3. Statistics- Theory, Methods & Application of D.C.Sancheti and V.K.Kapoor.

Reference Books:

1. Roger E. Kirk Statistics: An Introduction, Fifth Edition, Thomson-Wadsworth Publication.
2. Mc Clave, Benson and Sincich, Statistics for Business and Economics, Eleventh Edition, Prentice Hall Publication.

Web Resources:

1. https://ug.its.edu.in/sites/default/files/Business%20Statistics.pdf
2. https://archive.nptel.ac.in/courses/110/107/110107114/

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes	Programme Specific Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1	3	1	2	1	1	1	3	2	3	3	3	2
CO2	3	3	1	1	3	1	2	1	1	1	3	2	3	3	2	3
CO3	3	3	2	2	1	1	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	1	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Business Mathematics	4	5	-	-	**Theory**

Course Introduction : This course enable the students to learn the Application of Mathematics with respect to business application.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able
CO 1:	To recall the fundamental concepts of profit and loss

CO 2:	To explain the suitability of interest in business situation
CO 3:	To understand the fundamental concepts of stock exchange and its related problems
CO 4:	To apply the concept of matrix in system of linear equation
CO 5:	To understand the concept of LPP and construct the solution by using the graphical method.

Unit I:	**Profit and Loss**	**[12 Periods]**

Cost Price, Selling Price, Marked price, Loss, Trade discount and Cash discount, Commission, Brokerage, Problems on these topics

Unit II:	**Interest**	**[12 Periods]**

Concept of present value, Simple Interest, Compound interest, Amount at the end of period, Equated Monthly Installment (EMI) by reducing and flat interest system, problems.

Unit III:	**Shares**	**[12 Periods]**

Concept of share, Stock Exchange, Face value, Market Value, Dividend, Equity shares, Preference shares, Bonus shares, Examples.

Unit IV:	**Matrices and Determinants**	**[12 Periods]**

Definition of a Matrix, Types of Matrix, Finding inverse of a matrix by Adjoint method. Solution of a system of linear equations having unique solution and involving not more than three variables problems.

Unit V:	**Linear Programming Problems**	**[12 Periods]**

Linear Programming Problems - Graph of linear equation, Graph of linear inequality, Formulation of LPP, Solution by Graphical method, Problems relating to two variables

Text Books:

1. Business Mathematics - V. K. Kapoor (S. Chand and Sons, Delhi)
2. Business Mathematics - Bari

Reference Books:

1. Problems in Operation Research - P. K. Gupta and Man Mohan
2. Qualitative Methods and Operation Research - G. Gopikuttan (Himalaya Publishing House)

Web Resources:

1. https://youtu.be/KaLA1cWhQlA?si=q2knsjnVWWhHXaxn
2. https://youtu.be/a2QgdDk4Xjw?si=9TynGaOn7a-4DyzZ

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	3	2	2	2	2	2	3	2	3	3	3	2
CO2	3	3	1	1	3	2	2	2	2	2	3	2	3	3	2	3
CO3	3	3	2	2	1	2	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Allied I - Mathematics – I	4	5	-	-	**Theory**

Course Introduction

This course enables the students to gain knowledge on theory of equations, matrices, basic trigonometric concepts and its applications.

Course Focus on: Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will able

CO 1:	To recall the fundamental concepts of Theory of Equations.
CO 2:	To make use of Eigen values and Eigen vectors to build the Inverse of the Matrix
CO 3:	To determine and Expansion of Cosines and Sines.
CO 4:	To determine the possible ways to curvature and Radius of Curvature.
CO 5:	To discover and use of Beta Gamma Function.

Unit I:	**Theory of Equations**	**[12 Periods]**

Polynomial Equations with real coefficients irrational roots, complex roots - symmetric function of roots Transformation of equations by increasing or decreasing roots by a constant – Reciprocal Equations - Newton's method to find a root approximately.

Unit II:	**Matrices**	**[12 Periods]**

Fundamental Concepts-Rank of a matrix- Eigen Values and eigen vectors, Cayley-Hamilton theorem (without proof) – Verification and computation of inverse.

Unit III:	**Trigonometry**	**[12 Periods]**

Expansion in Series – Expansion of $\cos^n \theta$, $\sin^n \theta$, in a series of cosines and sines of multiples of θ – Expansions of $\cos n\theta$ and $\sin n\theta$ in powers of sines and cosines. Exponential Series and Hyperbolic Functions.

Unit IV:	**Curvature**	**[12 Periods]**

Polar Curves-Equation of a straight Line- Length of arc in polar coordinates- Pedal Equations-Radius of curvature – center of curvature – circle of curvature

Unit V:	**Beta Gamma Function and Multiple Integrals**	**[12 Periods]**

The Gamma Function-Relationship between Beta and Gamma Function
Double Integral and Triple Integral.-Simple Problems.

Text Books:

1. 1. " Mathematics for B.Sc. Branch I", Volume I & Volume II, , Kandasamy. P, Thilagavathi. K S.Chand and Company Ltd, New Delhi, 2004.

Contents :

Unit-I	P.No 1 to 65(Vol-I)
Unit-II	P.No 3 to 57(vol-II)
Unit-III	P.No 122 to148 (Vol-I)
Unit-IV	P.No 305 to 344(vol –II)
Unit-V	P.No 397 to 404 , 432-444. (vol –II)

Reference Books:

1. 1. T.K. Manichavasagam Pillai and S.Narayanan," Trigonometry", Viswanathan Publishers and Printers Pvt. Ltd,2013.
2. Narayanan S. and Manicavasagam Pillay T. K, Calculus Volume - I, S. Viswanathan Pvt. Ltd, 2010

Web Resources:

1. https://youtu.be/BW06kYfEC6Q?si=ab83Jb4v4PykJ_NC

2. https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1	3	1	2	2	2	1	3	2	3	3	3	2
CO2	3	3	1	1	3	1	2	2	2	1	3	2	3	3	2	3
CO3	3	3	2	2	1	1	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	1	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Allied II - Mathematics-II	4	5	-	-	**Theory**

Course Introduction This course presents the idea of co-ordinate goemetry, sphere, Laplace transforms and its applications.

Course Focus on: Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will able
CO 1:	To apply the concept of geometry and its related applications.

CO 2:	To demonstrate the concept of sphere and its properties.
CO 3:	To experiment the fundamental concepts of statics with respect to real life mechanism.
CO 4:	To analyze the concept of resultant of coplanar forces in different planes.
CO 5:	To examine the concept of couples and parallel forces in different systems.

Unit I:	**Co-ordinate Geometry**	**[12 Periods]**

Distance between two points-The angle between two lines- The plane-The straight line-Two straight lines.

Unit II:	**Sphere**	**[12 Periods]**

The equation of a sphere-The plane and the sphere-Centre and radius of a sphere.

Unit III:	**Laplace Transforms**	**[12 Periods]**

Definition – Laplace Transform of Standard function s – Linearity property – First shifting theorem – Transform of *tf(t), f(t) / t* and derivatives – Inverse Laplace transforms of standard functions.

Unit IV:	**Applications of Laplace transforms:**	**[12 Periods]**

Applications of Laplace transforms of differential equations of first and second order – Fourier series of functions in $(0, 2\pi)$.

Unit V:	**Differential Equations:**	**[12 Periods]**

Introduction- Equations of the first order and of degree Higher than one- Linear equations-Linear equations with constant coefficients-Determination of Particular integral and complement function.- Simple Problems.

Text Books:

" Mathematics for B.Sc. Branch I", Volume III , Kandasamy. P, Thilagavathi. K S.Chand and Company Ltd, New Delhi, 2004.

Contents:

Unit-I P.No 261-337(vol-III)
Unit-II P.No 338-389 (vol-III)
Unit-III P.No 187-225 (vol-III)
Unit-IV P.No 225-245 (vol-III)
Unit-V P.No 1-40 (vol-III)

Reference Books:

1. P. DuraiPandian & Kayalal Pachaiyappa, "Analytical Geometry 3D", Emerald Publishers, Chennai. 2009.
2. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand, 18th edition, 2016.

Web Resources:

1. https://youtu.be/Im242eBqaxw?si=JWYvmrj_kYzjg-zv
2. https://youtu.be/NXw2zvpUVbw?si=o_6bVcJHkJ0JPP_V

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	3	1	2	1	2	2	3	2	3	3	3	2
CO2	3	3	1	1	3	1	2	1	2	2	3	2	3	3	2	3
CO3	3	3	2	2	1	1	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	1	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Business Mathematics	4	5	-	-	**Theory**

Course Introduction : This course enable the students to learn the Application of Mathematics with respect to business application.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able

CO 1:	To recall the fundamental concepts of profit and loss
CO 2:	To explain the suitability of interest in business situation
CO 3:	To understand the fundamental concepts of stock exchange and its related problems
CO 4:	To apply the concept of matrix in system of linear equation
CO 5:	To understand the concept of LPP and construct the solution by using the graphical method.

Unit I:	**Profit and Loss**	**[12 Periods]**

Cost Price, Selling Price, Marked price, Loss, Trade discount and Cash discount, Commission, Brokerage, Problems on these topics

Unit II:	**Interest**	**[12 Periods]**

Concept of present value, Simple Interest, Compound interest, Amount at the end of period, Equated Monthly Installment (EMI) by reducing and flat interest system, problems.

Unit III:	**Shares**	**[12 Periods]**

Concept of share, Stock Exchange, Face value, Market Value, Dividend, Equity shares, Preference shares, Bonus shares, Examples.

Unit IV:	**Matrices and Determinants**	**[12 Periods]**

Definition of a Matrix, Types of Matrix, Finding inverse of a matrix by Adjoint method. Solution of a system of linear equations having unique solution and involving not more than three variables problems.

Unit V:	**Linear Programming Problems**	**[12 Periods]**

Linear Programming Problems - Graph of linear equation, Graph of linear inequality, Formulation of LPP, Solution by Graphical method, Problems relating to two variables

Text Books:

1. Business Mathematics - V. K. Kapoor (S. Chand and Sons, Delhi)
2. Business Mathematics - Bari

Reference Books:

1. Problems in Operation Research - P. K. Gupta and Man Mohan
2. Qualitative Methods and Operation Research - G. Gopikuttan (Himalaya Publishing House)

Web Resources:

1. https://youtu.be/KaLA1cWhQlA?si=q2knsjnVWWhHXaxn
2. https://youtu.be/a2QgdDk4Xjw?si=9TynGaOn7a-4DyzZ

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	3	2	2	2	2	2	3	2	3	3	3	2
CO2	3	3	1	1	3	2	2	2	2	2	3	2	3	3	2	3
CO3	3	3	2	2	1	2	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Biostatistics and Computer Applications I	4	5	-	-	**Theory**

Course Introduction : This course has been designed to enable the students to learn the Application of Statistics in the field of Biology.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able

CO 1:	To provide the basics of Biostatistics.
CO 2:	To describe the Measures of location and dispersion.
CO 3:	To apply the concept of probability theory in research
CO 4:	To identify the hardware parts in a computer
CO 5:	To illustrate different utilities available in Microsoft Excel software

Unit I:	**Introduction to Statistics**	**[12 Periods]**

Nature and Scope of Statistical methods and their limitations - Data collection -Classification and Tabulation - Primary and Secondary data and their applications in life sciences - Diagrams - Line diagram, Bar diagram and Pie diagram - Graphical presentation - Histogram and Ogives.

Unit II:	**Measures of Location and Dispersion**	**[12 Periods]**

Measures of Location and Dispersion - Stem and Leaf plots - Box and Whisker Plots - Co - efficient of variation - Skewness and its measures.

Unit III:	**Probability**	**[12 Periods]**

Concept and Definition - Addition and Multiplication theorems of Probability (statement only) - simple problems - Binomial, Poisson and Normal distributions (without proof) - simple problems.

Unit IV:	**Introduction to Computers**	**[12 Periods]**

Classification - Generations - Low, Medium and High level languages - Software and Hardware - Operating Systems - Compilers and Interpreters - Personal, Mini, Main frame and Super computers - their characteristics and application, BIT, BYTE, WORD computer memory and types; data representation and storage, binary codes, binary system.

Unit V:	**Microsoft Excel**	**[12 Periods]**

Data entry - Graphs - Aggregate functions - formulae and functions (students are expected to be familiar with all operations) - different number systems and conversions, input and output devices, secondary storage media - Numerical problems based on Units I to IV may be worked using Microsoft Excel

Text Books:

1. Daniel W.W (1995) Bio statistics : A Foundation for Analysis in Health Science, 6th Edition, John Wiley
2. Camphell R.C (1989) Statistics for Biologist, Cambridge University Press.

Reference Books:

1. Snedecor G.W and Cochran W.G (1967) Statistical Methods, Oxford Press
2. R.K Taxali: PC Hardware and Software, Galgotia Publication.

Web Resources:

1. https://youtu.be/sAjqBfAdbJM?si=nEZeLd0EKQ-HZ6Ta

2. https://youtu.be/-ujVQzTtxSg?si=kG-bwbfYErq8jj28

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CO1	2	3	2	2	3	2	2	1	2	2	3	2	3	3	3	2
CO2	3	3	1	2	3	2	2	1	2	2	3	2	3	3	2	3
CO3	3	3	2	2	1	2	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Biostatistics and Computer Applications II	4	5	-	-	**Theory**

Course Introduction : To enable the students to learn the Application of Mathematics with respect to business application.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able

CO 1:	To gain knowledge on correlation, regression and its coefficients.
CO 2:	To understand the basic principles of curve fitting and sampling.
CO 3:	To learn about the concept of various distributions and testing of significance.
CO 4:	To define and demonstrate the concepts of estimation and non-parametric tests.
CO 5:	To identify the type of statistical situation to which different distributions can be applied.

Unit I:	**Correlation and Regression**	**[12 Periods]**

Correlation -Scatter diagram -Karl Pearson's co -efficient of Correlation -Co -efficient of determination -Spearman's Rank Correlation -Linear Regression.

Unit II:	**Curve fitting**	**[12 Periods]**

Fitting of Linear, Parabolic and Exponential curves. Need for Sampling -Methods of Sampling -Simple random, Stratified random, Systematic random and Cluster sampling -Sampling and Non -sampling errors

Unit III:	**Concept of Sampling Distribution**	**[12 Periods]**

Standard error -Tests of significance based on Normal,'t', 'F' and Chi square distributions.

Unit IV:	**Non -parametric tests**	**[12 Periods]**

Advantages and Disadvantages -Uses -Sign test, Mann -Whitney 'U' test, Kruskal -Wallis test, Run test and Median test.

Unit V:	**Analysis of Variance**	**[12 Periods]**

One way and Two way Classifications -Principles of Experimentation -Completely Randomized Design and Randomized Block Design.

Text Books:

1. Daniel W.W (1995) Bio statistics : A Foundation for Analysis in Health Science, 6th Edition, John Wiley
2. Camphell R.C (1989) Statistics for Biologist, Cambridge University Press
3. Snedecor G.W and Cochran W.G (1967) Statistical Methods, Oxford Press
4. R.K Taxali: PC Hardware and Software, Galgotia Publication.

Reference Books:

1. Navanitham, P.A," Business Mathematics & Statistics" Jai Publishers, Trichy-21(2015)
2. Roger E. Kirk Statistics: An Introduction, Fifth Edition, Thomson-Wadsworth Publication.

Web Resources:

1. https://youtu.be/G5FkaxWBtkM?si=_kTR5Mn3bdDIe9mE
2. https://youtu.be/q48uKU_KWas?si=2LAYHfHA0JaIbb4x

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CO3	3	3	2	2	1	2	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3

CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Psychological Statistics	4	5	-	-	**Theory**

Course Introduction : This course introduces the application of statistical tools on industrial and environmental Study and analyses. It enables the students to learn the statistical methods and their applications in psychology.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will able
CO 1:	To gain knowledge on basics of statistics.
CO 2:	To understand the concept of data and its representation.
CO 3:	To learn about the concept of hypothesis testing and distributions.
CO 4:	To define and demonstrate the concepts of central tendency.
CO 5:	To analyze Statistical data using variance and Anova.

Unit I:	**Introduction to Statistics**	**[12 Periods]**

Meaning and Definition Statistics -Characteristics of Statistics -Nature and Scope of Statistics -Uses and Limitations of Statistics -Application of Statistics in Psychology -Meaning and Definition of variable -Dependent variable -Independent variable -Descriptive Statistics -Inferential Statistics.

Unit II:	**Data Representation**	**[12 Periods]**

Introduction -Meaning of Enquiry -Planning and Designing of Enquiry -Primary Data -Secondary Data -Framing a schedule -Classification and Tabulation of Data -Frequency Distribution. Diagrammatic -Graphic Representation of Data -Cumulative Percentage -Frequency.

Unit III:	**Measures of Central Tendency**	**[12 Periods]**

Meaning and Purpose of Measures of Central Tendency -Characteristics and Types of Measures -Characteristics and Uses of Mean -Median and Mode -Computation of Mean -Median and Mode Meaning -Purpose and Uses of Percentiles -Percentile Ranks -Its Application in Psychology

Unit IV:	**Concept of Variability**	**[12 Periods]**

Meaning and Importance of Variability -Range -Quartiles Quantity Deviations -Mean Deviation -Standard Deviation -Computation and Uses -Application in Psychology

Unit V:	**Analysis of variance**	**[12 Periods]**

Meaning, purpose and assumptions of Analysis of variance -One way and Two way ANOVA -Meaning and assumptions of distribution free statistics -Chi square. Meaning and Characteristics of Correlation -Types of Correlation -Person's Product Moment Correlation -Spearman's Rank Correlation.

Text Books:

1. Kothari, C. R. , Research Methodology: Methods and Techniques, New Age International Publishers, 2 nd Edition, 2007. (Unit I-V)
2. Garrett, H.E. , Statistics in Psychology and Education, New Delhi: Paragon International Publishers, 6th Edition, 2004.

Reference Books:

1. Kumar, P, Psychological Statistics, Jaipur: Aavishkar Publishers, 1St Edition, 2006.
2. Girija, M., Sasikala, L.,and Girija., Introduction to Statistics, New Delhi: Vrinda Pub-lication, 1 st Edition, 2004.

Web Resources:

1. https://youtu.be/q48uKU_KWas?si=2LAYHfHA0JaIbb4x

2. https://youtu.be/Z-nIdGIkjpw?si=4dhpdpdqA9jaJbVg

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

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CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Allied – Quantitative Techniques	4	5	-	-	**Theory**

Course Introduction :

This course presents a study that enables the students to acquire knowledge of Mathematics & Operations Research and their use in business decision making.

Course Focus on: Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes	On completion of this course, students will able
CO 1:	Understand the fundamental concepts of Linear Programming Problem
CO 2:	Examine the concepts of Transportation problem in a suitable case.
CO 3:	Construct the problems based on Assignment
CO 4:	Apply the concepts of Queuing Theory with different models
CO 5:	Evaluate the problems on Network scheduling

Unit I:	**Introduction to O.R**	**[12 Periods]**

Formulation of Linear Programming Problem – Graphical Solutions of LP.P: Feasible solution – Unbounded solution – Infeasible solution - Case study from the above topic.

Unit II:	**Transportation problem**	**[12 Periods]**

Introduction– North West Corner Rule – Least Cost Method – Vogel's Approximation Method — Balanced and Unbalanced Transportation Problems - Case study from the above topic.

Unit III:	**Assignment problem**	**[12 Periods]**

Balanced Assignment Problems – Hungarian Assignment method - Unbalanced Assignment Problems – Maximization case in Assignment Problem- Case study from the above topic.

Unit IV:	**Queuing Theory**	**[12 Periods]**

Introduction – Queuing system – Characteristics of Queuing system – symbols and Notation – Classifications of queues – Problems in (M/M/1) : (∞/FIFO);(M/M/1) : (N/FIFO) Models- Case study from the above topic.

Unit V:	**Network Analysis**	**[12 Periods]**

CPM : Basic Components – Rules of Network construction - Network representation - simple problems – Critical Path Analysis - Backward pass - Forward pass - Computation - PERT Network - Case study from the above topic .

Text Books:

1. P.A.Navanitham, **"**Business Mathematics & Statistics" Jai Publishers, Trichy-21
2. Business Mathematics by V. K. Kapoor - Sultan chand & sons, Delhi
3. Kanti Swarup, P.K. Gupta,Man Mohan-Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi-2008.

Contents:

Unit I : Book 3 - Chapter 1: Sections: 1.1, 1.2, 1.4, 1.6, 1.9
Chapter 2: Sections: 2.1, 2.2.
Chapter 3: Sections: 3.2, 3.3.
Unit II : Book 3 - Chapter10: Sections: 10.1-10.8.
Unit III : Book 3 - Chapter 11:Sections:11.1-11.4.
Unit IV : Book 3 - Chapter 25:Sections:21.1-21.8.
Unit V : Book 3 - Chapter 25:Sections:25.1-25.8.

Reference Books:

1. Sanchetti, D.C and Kapoor, V.K," Business Mathematics", Sultan chand Co&Ltd, New Delhi
2. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.

Web Resources:

1. https://youtu.be/YHa2TMbUpG0?si=gtEgpoFK5a3m8n-f

2. https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/MODULE-4-Queueing-Theory.pdf

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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CO3	3	3	2	2	1	2	3	3	2	3	3	2	3	2	3	2
CO4	3	3	3	2	2	3	2	1	2	2	3	2	3	2	3	3
CO5	2	3	3	3	3	2	3	3	2	3	3	2	3	3	2	2